WHAT IS CLAIMED IS:

1. A data storage device for use with a beam transmitter configured to transmit a beam, comprising:

a luminescent layer comprising a luminescent material capable of emitting light while being bombarded by the beam from the beam transmitter;

a detector located near the luminescent layer for detecting the light emitted from the luminescent layer; and

a phase-change layer located between the luminescent layer and the detector, said phase-change layer able to transform from a first phase to a second phase;

wherein light emitted from the luminescent layer and received by the detector materially differs when the phase-change layer transforms from the first phase to the second phase.

2. The device of claim 1, wherein the first phase of the phase-change layer enables transmission of materially more light through the phase-change layer from the luminescent layer to the detector than the second phase of the phase-change layer.

3. The device of claim 2, wherein the first phase of the phase-change layer represents an unwritten region of the phase-change layer and the second phase of the phase-change layer represents a written region of the phase-change layer.

4. The device of claim 2, wherein the first phase of the phase-change layer represents a written region of the phase-change layer and the second phase of the phase-change layer represents an unwritten region of the phase-change layer.

5. The device of claim 1, wherein the beam comprises a low power density photon beam lacking sufficient power to cause the phase-change layer to change from the first phase to the second phase.

6. The device of claim 1, wherein the beam comprises a low power density electron beam lacking sufficient power to cause the phase-change layer to change from the first phase to the second phase.

7. The device of claim 1, wherein the luminescent layer comprises a material having a high thermal conductivity.

8. The device of claim 1, wherein the luminescent layer comprises a material having a low thermal conductivity.

9. The device of claim 1, wherein the luminescent layer and the phase-change layer are adjacent and share an interface.

10. The device of claim 9, wherein the interface has a radiative recombination rate and a non-radiative recombination rate that each depend on whether the neighboring region of the phase-change layer is in the first phase or the second phase.

11. The device of claim 1, wherein the luminescent layer comprises at least one of a YAG-based material, a rare earth element dopant, a YAP-based material, GaN, Zn oxide, Zn sulfide, and Si_3O_4.

12. The device of claim 1, wherein the luminescent layer comprises an optically neutral medium and optically active nanoparticles in the optically neutral medium.

13. A data storage device for use with a beam transmitter configured to transmit a beam, comprising:

a luminescent layer comprising a luminescent material capable of emitting light while being bombarded by the beam from the beam transmitter;

a phase-change layer located between the luminescent layer and the beam transmitter, said phase-change layer able to transform from a first phase to a second phase; and

a detector located proximate the luminescent layer for detecting the light emitted from the luminescent layer;

wherein said luminescent layer is positioned between the phase-change layer and the detector, and further wherein light emitted from the luminescent layer and received by the detector materially differs when the phase-change layer transforms from the first phase to the second phase.

14. The device of claim 13, wherein the first phase of the phase-change layer enables transmission of materially more light from the luminescent layer to the detector than the second phase of the phase-change layer.

15. The device of claim 14, wherein the first phase of the phase-change layer represents an unwritten region of the phase-change layer and the second phase of the phase-change layer represents a written region of the phase-change layer.

16. The device of claim 14, wherein the first phase of the phase-change layer represents a written region of the phase-change layer and the second phase of the phase-change layer represents an unwritten region of the phase-change layer.

17. The device of claim 13, wherein the beam comprises a low power density beam lacking sufficient power to cause the phase-change layer to change from the first phase to the second phase.

18. The device of claim 13, wherein the luminescent layer comprises at least one of a YAG-based material, a rare earth element dopant, a YAP-based material, GaN, Zn oxide, Zn sulfide, and Si_3O_4.

19. A device for use with a beam transmitter configured to transmit a beam, comprising:

a luminescent layer comprising a luminescent material capable of emitting light while being bombarded by the beam from the beam transmitter;

a detector located near the luminescent layer and the beam transmitter for detecting the light emitted from the luminescent layer; and

a phase-change layer located adjacent the luminescent layer such that the luminescent layer is positioned between the detector and the phase-change layer, said phase-change layer able to transform from a first phase to a second phase;

wherein light emitted from the luminescent layer and received by the detector materially differs when the phase-change layer transforms from the first phase to the second phase.

20. The device of claim 19, wherein the first phase of the phase-change layer enables transmission of materially more light from the luminescent layer to the detector than the second phase of the phase-change layer.

21. The device of claim 20, wherein the first phase of the phase-change layer represents an unwritten region of the phase-change layer and the second phase of the phase-change layer represents a written region of the phase-change layer.

22. The device of claim 20, wherein the first phase of the phase-change layer represents a written region of the phase-change layer and the second phase of the phase-change layer represents an unwritten region of the phase-change layer.

23. The device of claim 19, wherein the beam comprises a low power density beam lacking sufficient power to cause the phase-change layer to change from the first phase to the second phase.

24. The device of claim 19, wherein the luminescent layer comprises at least one of a YAG-based material, a rare earth element dopant, a YAP-based material, GaN, Zn oxide, Zn sulfide, and Si_3O_4.

25. The device of claim 19, further comprising an anti-reflective coating located proximate the phase-change layer.

26. The device of claim 19, further comprising a thermal diffusion layer located proximate the phase-change layer.

27. The device of claim 19, further comprising a reflective layer proximate the phase-change layer.

28. The device of claim 19, wherein the phase-change layer comprises a plurality of layers of phase-change material.

29. The device of claim 19, wherein the luminescent layer comprises a plurality of layers of luminescent material.

30. The device of claim 1, further comprising an anti-reflective coating located proximate the phase-change layer.

31. The device of claim 1, further comprising a thermal diffusion layer located proximate the phase-change layer.

32. The device of claim 1, further comprising a reflective layer proximate the phase-change layer.

33. The device of claim 1, wherein the phase-change layer comprises a plurality of layers of phase-change material.

34. The device of claim 1, wherein the luminescent layer comprises a plurality of layers of luminescent material.

35. The device of claim 13, further comprising an anti-reflective coating located proximate the phase-change layer.

36. The device of claim 13, further comprising a thermal diffusion layer located proximate the phase-change layer.

37. The device of claim 13, further comprising a reflective layer proximate the phase-change layer.

38. The device of claim 13, wherein the phase-change layer comprises a plurality of layers of phase-change material.

39. The device of claim 13, wherein the luminescent layer comprises a plurality of layers of luminescent material.

40. A method for storing data on a data storage device comprising a phase change layer and a luminescent layer, the method comprising:

bombarding the luminescent layer with a beam, causing the luminescent layer to emit light;

detecting the light emitted from the luminescent layer using a detector; and

writing data by transforming the phase change layer from a first phase to a second phase;

wherein light emitted from the luminescent layer and detected by the detector materially differs when the phase-change layer transforms from the first phase to the second phase.